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NAVAL POSTGRADUATE SCHOOL

MONTEREY, CALIFORNIA

MBA PROFESSIONAL REPORT

A DATA ANALYSIS OF NAVAL AIR SYSTEMS COMMAND FUNDING DOCUMENTS

June 2017

**By: Edward P. Windas
 John J. Peach III**

**Advisors: Ryan Sullivan
 Daniel Nussbaum**

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**A DATA ANALYSIS OF NAVAL AIR SYSTEMS COMMAND FUNDING
DOCUMENTS**

Edward P. Windas, Lieutenant Commander, United States Navy
John J. Peach III, Lieutenant, United States Navy

Submitted in partial fulfillment of the requirements for the degree of

MASTER OF BUSINESS ADMINISTRATION

from the

**NAVAL POSTGRADUATE SCHOOL
June 2017**

Approved by: Ryan Sullivan, Co-Advisor

Daniel Nussbaum, Co-Advisor

Don Summers
Academic Associate
Graduate School of Business and Public Policy

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A DATA ANALYSIS OF NAVAL AIR SYSTEMS COMMAND FUNDING DOCUMENTS

ABSTRACT

This research looks at the financial transactions that occurred within United States Naval Air Systems Command (NAVAIR) between fiscal years 2012–2016. It analyzes over 180 thousand transactions with a total value in excess of 146 billion dollars. NAVAIR uses the Navy Enterprise Resource Planning (ERP) system to process its financial transactions and, since its implementation, there has been an increase in the overall number of transactions. As a result, there is an effort underway to reduce the number of transactions. This research provides insights into NAVAIR business practices, develops a metric with which to gauge efficiency and benchmark performance, and provides a few simple linear regression equations to determine adherence to the newly established benchmarks.

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LIST OF ACRONYMS AND ABBREVIATIONS

ACRN	Accounting Classification Reference Number
AIS	Automated Information System
APN	Aircraft Procurement, Navy
APPN	appropriation
ASN	Assistant Secretary of the Navy
AT&L	Acquisition, Technology, & Logistics
BFM	Business & Financial Managers
COMFRC	Commander Fleet Readiness Center
DAU	Defense Acquisition University
DCAA	Defense Contract Audit Agency
DFAR	Defense Federal Acquisition Regulation
DOD	Department of Defense
DODI	Department of Defense Instruction
EAO	Economy Act Order
ERP	enterprise resource planning
FAR	Federal Acquisition Regulation
FMC	foreign military sales
FY	fiscal year
H1D	direct cite purchasing group code
H1F	reimbursable purchasing group code
HQ	headquarters
IPR	interdepartmental purchase request
MILCON	Military Construction
MILPERS	Military Personnel
MIPR	military interdepartmental purchase request
NAE	Naval Aviation Enterprise
NAVAIR	Naval Air Systems Command
NAWC	Naval Air Warfare Center
NDAA	National Defense Authorization Act
NWCF	Navy Working Capital Fund

OMN	Operations and Maintenance, Navy
OPN	Other Procurement, Navy
OSD	Office of the Secretary of Defense
PANMC	Procurement of Ammo Navy and Marine Corps
PEO	Program Executive Officer
PMA	program manager air
PO	purchase order
PR	purchase request
PRLI	purchase request line items
R	Reserve
RD&A	Research Development and Acquisition
RDT&E	Research Development Test and Evaluation
SCN	Ships and Conversion, Navy
SOO	statement of objectives
SOW	statement of work
SPS	Standard Procurement System
SYSCOM	Systems Command
TDE	total dollars executed
TOA	Total Obligation Authority
USD	Undersecretary of Defense
WCF	working capital fund
WPN	Weapons Procurement, Navy
ZFD	intragovernmental funding document
ZSPS	Standard Procurement System

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I. INTRODUCTION

This research looks at the financial transactions that occurred within United States Naval Air Systems Command (NAVAIR) between fiscal years (FY) 2012–2016. It analyzes over 180 thousand transactions with a total value exceeding 146 billion dollars. These transactions consist of both internal Department of Defense spending and purchases from external commercial vendors.

A. BACKGROUND

A significant contributor to the Navy Financial Management workload is the creation, processing, and execution of funding documents. Each time a program office generates a funding document, it creates work at each level of the approval chain, diverting scarce resources—time and personnel—away from other vital program requirements. As such, there is an effort at NAVAIR to reduce the number of these transactions in order to boost both individual program productivity and the efficiency of the financial management chain of command approval process.

NAVAIR uses the Navy Enterprise Resource Planning (ERP) system to process financial transactions. According to the Navy ERP Program website, “Navy ERP is the Department of the Navy financial system of record,” and “approximately 50 percent of the Navy’s budget is currently executed within Navy ERP” (Navy ERP, n.d, para. 1 and 6). However, since its implementation, NAVAIR has conducted limited research on the massive amount of data produced by the system. NAVAIR 7.8 Program and Business Analysis Office are beginning to analyze this data and to look for opportunities to leverage this research to improve NAVAIR’s operations.

On 20 December 2013, the NAVAIR Comptroller and the Director of the Program and Business Analysis Office issued a joint memorandum requiring that, “monthly metrics will be provided measuring the number of NAVAIR HQ [headquarters] basic R&D [Research and Development] and Procurement funding documents...” in an overall effort to reduce the excessive quantity that are created on an annual basis

(NAVAIR, 2013, para. 3). However, the memorandum did not specify which metrics to report, and, as a result, no metrics were ever developed, implemented, or kept.

B. PURPOSE AND EXPECTED BENEFITS FROM RESEARCH

The purposes of this research are to

1. Conduct a data analysis of NAVAIR funding documents to provide insights into its business practices for processing purchase requests (PR), and
2. Look for ways to reduce the number of basic reimbursable funding documents. Including, specifically looking at the viability of placing more purchase request line items (PRLI) on a single purchase request, and
3. Develop metrics and benchmarks that NAVAIR could use to measure the performance of its program offices.

This research is being conducted at the request of NAVAIR 7.8 Program and Business Analysis Office. It will be immediately relevant to NAVAIR, with the goal of helping it change its business practices. The results will help NAVAIR work toward reducing the number of funding documents generated annually. This will reduce the administrative burden on NAVAIR Comptrollers and Business and Financial Managers (BFM), thereby increasing the overall efficiency of the organization. Additionally, this research will help to begin the study of Navy ERP data and follow-on research at other Naval System Commands (SYSCOM).

C. RESEARCH QUESTIONS

1. Primary Question

- How can financial transactions, generated from the Navy ERP System, be analyzed to provide insight into NAVAIR business practices?

2. Secondary Questions

- What metrics can be developed to measure the performance of NAVAIR program offices?
- How can these metrics be applied to identify the program offices currently implementing the best practices in order to assist

NAVAIR senior leadership in directing future funding document behavior?

- What should be the benchmarks of performance related to the purchase request process within NAVAIR program offices?

D. SCOPE AND LIMITATION

This data analysis looked at only financial data generated from the Navy ERP system generated specifically by NAVAIR headquarters (HQ), which is denoted by HQ01 in the data. It does not include any data from another Naval Systems Command or any other command. The data analysis was intentionally limited to data from FY2012–FY2016. It was also limited to three appropriations: Procurement, Research Development Test and Evaluation (RDT&E), and Operations and Maintenance Navy (OMN). The OMN data included OMN Reserve (R), and the Procurement data included Aircraft Procurement Navy (APN), Weapons Procurement Navy (WPN), Other Procurement Navy (OPN), and Procurement of Ammo Navy and Marine Corps (PANMC). Foreign Military Sales (FMS) data was also determined to be outside the scope of this research and therefore removed.

E. FINDINGS

After filtering the data provided by NAVAIR, we determined that focusing our data analysis on three key areas would provide us with the most insight. We focused our research on understanding the behavioral characteristics of PRs at NAVAIR, the development of metrics and benchmarks for NAVAIR program office performance, and the application of simple linear regression analysis to determine both current and future adherence to the established benchmarks.

We conclude that 55% of all total basic PRs at NAVAIR are intergovernmental funding documents (ZFD). However, this 55% is responsible for 80% of all follow-on amendments. When looking at PRLI, with a direct cite purchasing group code (H1D) ZFDs grow drastically from 8% of basics up to 39% of all follow-on amendments. These findings indicate that ZFD PRs are easy to amend, unlike their PR counterpart falling under the Standard Procurement System (ZSPS). This creates little incentive for BFM to

initially obligate the correct and full amount of funds on the basic PR. Therefore, we recommend that the PRLI to PR metric be used to monitor NAVAIR entities creating PRs.

We were also able to conclude that there is a strong relationship between the number of PRs created and the Total Obligation Authority (TOA). By knowing the TOA, and using the regression equations provided in this research, the approximate number of expected PRs within a FY can be forecasted. Additionally, there is a strong relationship between the number of PR and the total dollars executed (TDE) for Procurement, RDT&E, and OMN/R appropriations. This relationship allows for the estimation of the number of H1F or H1D ZFD PRs at any point in the FY.

F. ORGANIZATION

This research is organized into five chapters. Chapter II is a literature review discussing the organization of NAVAIR and its purpose, the Navy ERP System, a general overview of how the federal budget is executed, and the specific funding document processes within NAVAIR. Chapter III discusses the methodology used for this research and describes how the data analysis was conducted. Chapter IV covers our analysis results, and how our results could be applied at NAVAIR. Chapter V—conclusions, recommendations, and areas for further research—summarizes our findings, looks at how the results of the data analysis could impact future NAVAIR business practices, and suggests areas for further research.

II. LITERATURE REVIEW

This chapter presents an overview of the key organizations, processes, and concepts necessary to understand NAVAIR's reimbursable funding document creation process. Our study is unique in that it is the first of its kind to analyze raw purchase request data generated from a Navy ERP system old enough to provide multiple years of reliable transactions. The next section includes a description of NAVAIR, Navy ERP, an overview of how the DOD executes its budget, and finally, the rules governing funding document creation and processing at NAVAIR.

A. NAVAL AIR SYSTEMS COMMAND

One of the Navy's six Systems Commands, NAVAIR's mission is, "to provide full life-cycle support of naval aviation aircraft, weapons and systems operated by Sailors and Marines. This support includes research, design, development and systems engineering; acquisition; test and evaluation; training facilities and equipment; repair and modification; and in-service engineering logistics support" (NAVAIR, n.d., para. 2).

The main provider for the Naval Aviation Enterprise (NAE), NAVAIR takes the requirements generated from Navy and Marine Corps resource sponsors and provides the products and services the warfighter needs to accomplish the mission (NAE, 2016). As a systems command, NAVAIR's role in Naval Aviation is to:

1. "Develop, acquire and support aircraft, weapons and related systems which can be operated and sustained at sea,
2. Provide analysis and decision support for cost/ schedule/ performance trades and investment decisions, and
3. Increase Navy and Marine Corps capability, readiness and affordability in a joint/ coalition environment." (NAVAIR, 2017, p. 3)

NAVAIR provides direct support in the form of people, processes, tools, training, mission facilities, and core technologies to all of the programs authorized under the Assistant Secretary of the Navy for Research, Development, and Acquisition (ASN RD&A) (NAVAIR, n.d.). With each program accountable to a corresponding Program

Executive Officer (PEO) as illustrated in Table 1, NAVAIR accomplishes its mission via three main sub-divisions of the Naval Air Systems Command.

Table 1. NAVAIR Programs of Record.
Adapted from NAVAIR (2017).

PEO (T)	TACTICAL AIRCRAFT PROGRAMS
PMW/A-101	Multifunctional Information Distribution System
PMA-231	E-2/ C-2
PMA-234	EA-6B Prowler
PMA-251	Aircraft Launch and Recovery Equipment
PMA-257	AV-8B Harrier
PMA-259	Air-to-Air Missile Systems
PMA-272	Advanced Tactical Aircraft Protection Systems
PMA-265	F/A-18 / EA-18G
PMA-298	Air Warfare Mission Area
PMA-213	Naval Air Traffic Management Systems
PMA-273	Naval Undergraduate Flight Training Systems
PEO (A)	AIR ASW, ASSAULT AND SPECIAL MISSION PROGRAMS
PMA-261	Heavy Lift Helicopters
PMA-264	Air ASW Systems
PMA-275	V-22 Osprey
PMA-276	Light/ Attack Helicopters
PMA-299	Multi-Mission Helicopters
PMA-290	Maritime Patrol & Reconnaissance Aircraft
PMA-271	Airborne Strategic Command, Control & Communications
PMA-207	Commercial Transport & Support
PMA-274	Presidential/ Executive Lift Helicopters
PEO (U&W)	UNMANNED AVIATION AND STRIKE WEAPONS
PMA-281	Strike Planning and Execution Systems
PMA-201	Precision Strike Weapons
PMA-263	Small Tactical UAS
PMA-208	Navy Aerial Targets and Decoys
PMA-262	Persistent Maritime UAS
PMA-242	Direct and Time Sensitive Strike
PMA-266	Multi-Mission Tactical UAS
PMA-268	Unmanned Carrier Aviation
PMA-280	Tomahawk Weapons System
PEO (JSF)	JOINT STRIKE FIGHTER
AIR 1.0	POLICY/PROCESS/ TOOLS STEWARDSHIP ACROSS PROGRAMS
PMA-260	Aviation Support Equipment
PMA-226	Specialized and Proven Aircraft
PMA-209	Air Combat Electronics
PMA-205	Aviation Training Systems
PMA-202	Aircrew Systems
PMW/A-170	Communications and GPS Navigation

These divisions are NAVAIR HQ, the Naval Air Warfare Centers (NAWC) and the Fleet Readiness Centers (COMFRC). While the NAWCs and COMFRCs primarily relying on reimbursable funding from other mission-funded activities, NAVAIR HQ is directly involved in the programmatic functions of Navy's Aviation PEOs and their assigned programs. Organized into eight core "communities of practice," each with a specific focus, NAVAIR HQ oversees the bulk of all NAVAIR appropriated funding, and as such, is the focus of this report (NAVAIR, n.d., para. 3).

B. NAVY ENTERPRISE RESOURCE PLANNING

"An Enterprise Resource Planning System is a software-based management program that integrates the many operational functions of a business into a single computer system" (Carver & Jackson, 2006, p. 1). Carver and Jackson's design, by interlinking the data between various departments such as personnel management, inventory management, and finance, ERP enables different departments to communicate and the business to run more efficiently.

Before ERP, each individual department would operate its own standalone computer system with separate databases, leading to redundant inefficient financial operations. The introduction of ERP allowed for the consolidation of these individual databases under a single umbrella resulting in better synergy, enhanced reporting and analysis by management, and the elimination of redundancy, ultimately saving time and money (Carver & Jackson, 2006).

Motivated by the efficiencies gained by businesses in the private sector, the Navy first adopted ERP in 1998 with the mission to "reinvent and standardize Navy business processes for acquisition, financial and logistics operations" (Bogdanowicz, 2004, p. 6). Today, Navy ERP is the Department of the Navy's financial system of record, integrating complex business data into a single system to provide the Navy's major commands with the management functionality needed to excel in today's data-driven world. "Approximately 50 percent of the Navy's budget is currently executed using Navy ERP" (Navy ERP, n.d, para. 6).

Officially deployed at NAVAIR in 2007, Navy ERP now performs broad acquisition and financial functions to include General Fund and Navy Working Capital Fund (WCF) financial management, procurement, workforce management, and program/project management for the Navy's Air Systems Command (Carey & Valle, 2010). All NAVAIR financial transactions now flow through Navy ERP, creating a data source that is all encompassing, factual, sustainable, and repeatable.

C. OVERVIEW OF BUDGET EXECUTION IN THE DEPARTMENT OF DEFENSE

Budget execution in the Department of Defense is the act of committing, obligating, and expending the budget authority Congress grants via the National Defense Authorization Act and the subsequent Defense Appropriations Act. While execution can be a complicated matter, encompassing many facets of fiscal law and the competing objectives necessary to accomplish the mission, the following paragraphs in this section highlight the relevant aspects required to understand the research questions of this report.

When Congress appropriates funds, it does so in the form of budget authority. In other words, Congress grants authority for a specific program or activity to obligate the United States Treasury for a specific purpose, for the duration of a specific period, and for a specific amount. All funds appropriated by Congress are issued with these three guidelines: purpose, time, and amount. "For almost all budget managers, this body of law comprises a set of rules that guides their daily actions. For example, they know that they are not to commit funds before they have been appropriated, that they may not spend in excess of an appropriation, and they may only spend the appropriation on items for which the appropriation is made" (McCaffery & Jones, 2004, p. 322).

To illustrate the types of appropriations Congress issues, we can group them into five broad appropriation categories: Operations and Management (O&M), Research Development Testing and Evaluation (RDT&E), Procurement, Military Construction (MILCON), and Military Personnel (MILPERS). A sixth category, entitled Ships and Conversion Navy (SCN), although it is technically Procurement, is often distinguished as it follows a separate budgeting policy with unique timelines due to the extended lead

times necessary to build a ship. Figure 1 is a depiction of these appropriation categories and the timelines associated for obligations and expenditures.

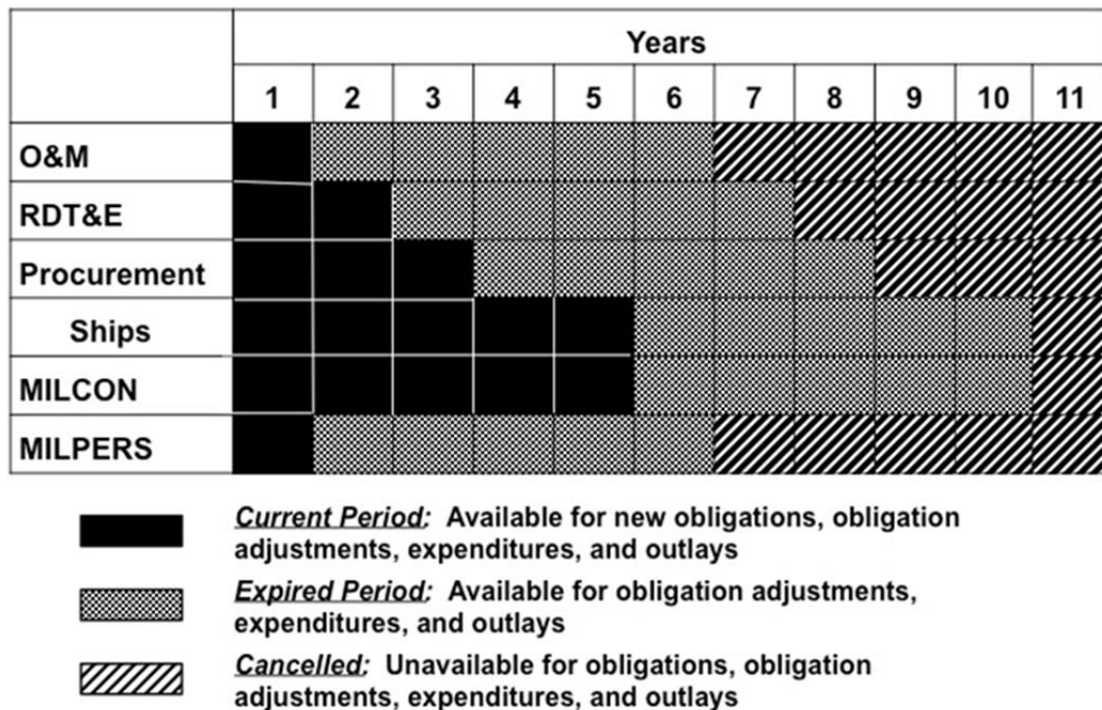


Figure 1. Appropriation Category Life Cycle. Source: DAU (2016).

1. Investment vs. Expenditure Accounts

Constrained by our research questions and the nature of spending for which NAVAIR Program Offices are appropriated, we can focus our attention on the first three appropriations listed in Figure 1, O&M, RDT&E, and Procurement. These three appropriations can then be segregated into two distinct categories that broadly define their purpose: Investment Accounts and Expenditure Accounts.

a. Investment Accounts

The Investment Accounts are comprised of both RDT&E and Procurement. This category of appropriation provides an investment in the future. Whether it is the research, development, testing, or evaluation of a new technology (as the RDT&E appropriation name suggests), or the production and purchase of a new weapon system, these two

appropriations are authorized in order to provide value in the future. Even though, “RDT&E funds are used for both investment-type costs (e.g., sophisticated laboratory test equipment) and expense-type costs (e.g., salaries of civilian employees at R&D-dedicated facilities),” for the purposes of this report, RDT&E is considered an Investment Account (DAU, 2017, para. 4).

RDT&E, as is illustrated in Figure 1, has a current period of two years. It is in these two years that the RDT&E appropriation is “fully functional,” available for new obligations, obligation adjustments, expenditures, and outlays. Per the Office of the Secretary of Defense (OSD) Execution Benchmarks (Table 2), RDT&E Appropriations should be 90% obligated at the end of the first year, and 100% obligated at the end of their second year. At the end of their second year, RDT&E funds expire and are then no longer available for new obligations. In the five years succeeding expiration, funds are only available for adjustments to obligations already in existence, and the subsequent expenditures and outlays associated. As depicted in Figure 1, the Expired Period of five years is universal for all DOD appropriations. Finally, at the end of the Expired Period, the appropriation is cancelled and no longer available for use.

Table 2. OSD Benchmarks per Application.
Adapted from AcqNotes (2016).

OSD Execution Benchmarks						
APPN. CATEGORY	First Year Available		Cumulative for Second Year		Cumulative for Third Year	
	Obligation	Expenditures	Obligation	Expenditure	Obligation	Expenditure
O&M	100%	75%	100%	100%	100%	100%
RDT&E	90%	55%	100%	90%	100%	100%
Procurement	80%	N/A	90%	N/A	100%	N/A

Similarly, Procurement funding has the same five years of expiration, only preceded by a three-year current period of availability as opposed to two like RDT&E. In these three years of availability, OSD Benchmarks dictate that 80% should be obligated at the end of the first year, 90% at the end of the second, and 100% at the end of the third. Because NAVAIR is largely program management focused, with a mission statement devoted to, “develop, deliver, and sustain aircraft, weapons, and systems,” the procurement appropriations they execute on are, for the most part, homogeneous across

they systems command (NAVAIR, 2017, para. 6). They consist of APN, WPN, OPN, and PANMC. Together, these four appropriations comprise the total of NAVAIR's Procurement budget.

b. Expenditure Accounts

As a systems command, the expenditure accounts that pertain to NAVAIR are OMN, and its reserve counterpart, Operations & Management Navy Reserve (OMNR). Both of these appropriation categories are the same in that they finance expenses that benefit a specific, limited time vice some future objective, as in an investment account (DAU, 2017). Per the DOD Financial Management Regulations, expenditures eligible for funding are defined as, "the costs incurred to operate and maintain the organization, such as personal services, supplies, and utilities" (Under Secretary of Defense (Comptroller), 2008, para. 010201.B.1). Examples of OMN include civilian pay, travel, consumables, spare parts, and base operations.

Additionally, due to the severable nature of the efforts they pay for, expenditure accounts such as OMN and OMNR are funded annually. This is illustrated in both Figure 1 and Figure 2. With a current period of availability of only one year, 100% must be obligated before expiration. However, as with investment accounts, once OMN funds expire after a year, they can continue to incur expenditures for a period over the next five years.

2. Types of Funding Transactions

Once funds are appropriated, there are a few ways the end user can obligate them. In this section, we will simplify these methods to three distinct types of funding transactions that specifically pertain to a program management-focused systems command such as NAVAIR. The types include Contracts with Commercial vendors, Direct Citations of funds, and Intragovernmental reimbursable transactions. Because both direct citations and intragovernmental reimbursable transactions require government action at two separate stages, and to maintain consistency with NAVAIR's funding document organizational process as highlighted in section D of this chapter, these two

types of funding transactions will be grouped under the heading “Intragovernmental Transactions.”

a. Contracts with Commercial Vendors

“The DOD has long relied on contractors to provide the U.S. military with a wide range of goods and services, including weapons, vehicles, food, uniforms, and operational support” (Schwartz, Sargent, Nelson, & Coral, 2016, p. 2). Of all the various ways to obligate funds, the bulk of all DOD dollars are put directly on contract with companies in the private sector in this fashion. These contracts represent a bilateral agreement between the DOD and a commercial vendor to “provide a specific good or service to the government” (Candrea, 2017, p. 17).

For all federal agencies, these bilateral agreements are governed by the Federal Acquisition Regulation (FAR). For DOD, the Defense Federal Acquisition Regulation (DFAR) then supplements this guidance providing, “DOD-specific acquisition regulations that DOD government acquisition officials must follow in the procurement process for goods and services” (DCAA, n.d., para. 1). Funds are only obligated at the time the contract is signed.

b. Intragovernmental Transactions

However, not all DOD funds are placed directly on contract to a commercial vendor. Over 25% of the defense budget changes hands internally within the government prior to any money being put on contract with an outside vendor (Candrea, 2017). Due to its robust nature and the various disciplines of both the DOD and the federal government in general, it is often more efficient and/or economical to request the required goods or services from a supplying entity within the government. Volume 11A of the Financial Management Regulation, which governs intra-agency support, states, “DOD activities shall render requested support to other DOD activities when the head of the requesting activity determines it would be in the best interest of the United States Government, and the head of the supplying activity determines capabilities exist to provide the support without jeopardizing assigned missions” (Under Secretary of Defense (Comptroller), 2014, para. 030303).

These intragovernmental transactions occur via the transfer of budget authority from one command or agency to another. As granted by congress, an appropriation is the, “legal authority under an appropriations act to bind the government to make a payment from the treasury” (Candрева, 2017, p. 7). Therefore, intragovernmental transactions are simply a result of one command or agency allowing another command or agency to use its appropriation in a manner that “maximizes the benefit to the DOD as a whole” (Under Secretary of Defense (AT&L), 2013, para 3a). This transfer of budget authority can take a few different forms.

Reimbursable transactions occur when the servicing or supplying activity has not been appropriated funds by Congress to complete a certain task. This then requires the buying activity to “reimburse” the supplying activity the full amount of costs necessary to provide the good or service. An example of a reimbursable transaction is a NAVAIR program manager air (PMA) procuring engineering support from the NAWC (Candрева, 2017). The PMA must transfer the appropriate amount of budget authority to the NAWC in order to pay for the engineer’s services. The PMA records an obligation once the NAWC accepts the order, and the NAWC records the corresponding increase in budget authority. That increase in budget authority will then be used by the NAWC to cover the costs of the engineering services they provide to the PMA (Candрева, 2017).

Depending on the type of funding and the severability of the task requested, there are two major governing documents for reimbursable transactions. These documents are the “Economy Act,” Title 31 United States Code, section 1535, and the “Project Order Law,” Title 41, United States Code, section 6307. These two laws provide the, “legal authority and requirements for one U.S. Government entity to perform work for another” (Under Secretary of Defense [Comptroller], 2014, para. 010102A). Taking their names from the laws that govern them, a reimbursable transaction can come in one of two forms:

1. An Economy Act Order (EAO) is used for severable work, where the order expires when the funding expires (typically at the end of the fiscal year). To continue work, new current year money must be re-obligated (Candрева, 2017).

2. A Project Order (PO) is used for non-severable work, where the order expires only after the work is complete or funds are exhausted. PO money is allowed to cross fiscal years (Candrea, 2017).

Another form of intragovernmental transaction is a direct citation of funds. A direct citation of funds, or more commonly a “direct cite,” is when one activity grants authorization for another activity to use its appropriation, but the budget authority never officially changes hands as it does on a reimbursable EAO or PO (Candrea, 2017). If a reimbursable is like paying a friend who is good with engines to work on your car, a direct cite is like trusting your money to a friend who is knowledgeable about the local car repair industry to hire a trustworthy mechanic on your behalf. In the first instance, your money is obligated when your friend agrees to do the work; whereas in the second instance, it is only obligated after your friend finds and hires a mechanic. This distinction is illustrated in Figure 3, “Comparing the Types of Intragovernmental Transactions.” This type of intragovernmental transfer is common when one government agency requests the use of an established contracting vehicle that another government activity already has in place with an outside commercial vendor. By “piggybacking” on an already negotiated contract, a requesting activity can save valuable time and money.

Table 3. Comparing the Types of Intragovernmental Transactions.
Adapted from Candrea (2017).

	REIMBURSABLE		NON-REIMBURSABLE
	Economy Act Order	Project Order	Direct Cite
Type of Task	Severable	Non-Severable	Either Severable or Non-Severable
Nature of Funding	Incremental Funding	Full Funding	Depends on Task
Funds	Expire at end of FY	Carryover between FY	Must be obligated before they expire
Time of Obligation	When work is accepted	When work is accepted	when contract is signed
Work Ceases	When funds expire or run out, whichever is first	When funds run out or work is complete, whichever comes first	Per the terms of the contract

D. NAVAIR FUNDING DOCUMENT PROCESS OVERVIEW

As NAVAIR’s financial system of record, all financial transactions are run through ERP. When a requirement materializes within a PMA, whether it requires a contract action or intragovernmental transaction, the BFM will enter it into ERP to create

a commitment of funds. Regardless of the time, purpose, or amount of the funding involved, the goal, and ultimate result of the BFM's efforts is the same: creation of a Purchase Request (PR) within ERP.

A PR (also known as a procurement request) is the electronic vehicle for the commitment, obligation, transfer, and overall general conveyance of financial information and instructions within ERP. Used interchangeably with the term, "Funding Document," a PR is created with all the relevant information necessary to formally obligate funds from the Treasury. This information includes everything from the requesting activity name and date, to the time, purpose, and amount of funding, to all the descriptive information necessary if the PR is funding a contract going to a commercial vendor. A sample of a few of these fields included on a PR are shown in Table 4.

Table 4. Example of PR Data

FULL FIELD TITLE EXPLANATION	EXAMPLE OF DATA	EXPLANATION
PURCHASE REQUEST	1400270027	10 digit serial # funding document
PURCHASE REQUEST LINE ITEM	00010	Multiple line items can be placed on a single PR
AMENDMENT	0004	# of times a PR has been changed or updated. The first PR is referred to as the 'Basic', and has an Amendment # of 0000
FUND CENTER	19ATP26500	The Navy activity who owns the FUND being obligated
REQUESTOR	PMA 265	The specific Navy entity creating the PR
VENDOR	NAVAL AIR WARFARE CENTER	The recipient of the PR
FUND	3112305250	10 digit Code denoting type, year, period availability, and budget line item # as found in the Federal Budget
DOCUMENT TYPE	ZFD	Denotes type of funding: ZSPS (contracting action with commercial vendor), or ZFD (intragovernmental transaction)
PURCHASE GROUP	H1D	Further defines Document Type
LINE TEXT	WIND TUNNEL STORE SEP TEST PLANNING	Short description of reason for PR
PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER	N0001912MP02030	A 13-17 digit code used to detail the procuring agency, FY, and type of funding instrument
ACCOUNTING CLASSIFICATION REFERENCE NUMBER	AA	Unique code included in contracts that denotes the specific source of funding provided by PR
CONTRACT LINE ITEM NUMBER	0001	Specific effort PR is funding
OBJECT CLASSIFICATION	310	Code detailing the good or service being purchased
MATERIAL GROUP	3590-GOV	Code that categorizes good being purchased
QUANTITY	1.00	# of item being purchased
REQUISITION REQUEST DATE	20120620	Date PR was initiated
FINAL APPROVAL DATE	20121015	Date PR was approved
FINANCIAL MANAGEMENT AMOUNT	50,000.00	Total amount of Purchase Request Line Item

Example of data column is not congruent with an actual PR, but selected to best highlight the field.

A PR is comprised of line items “PRLI” that can be used to fund different aspects of the same effort. These PRLIs can be added at different times via “Amendments” to change or alter the PR in some fashion. The first issuance of a PR is known as the “Basic” and it has an amendment number of 0000 that is automatically generated in ERP. Every amendment thereafter increases in serial fashion, starting with 0001 and continuing in ascending order. An amendment can add or decrease funding, or simply make text changes to the original funding document.

The first step in generating a PR is determining what type of document needs to be created. Though there are various official forms that have historically been used for the purchase of goods and services, Navy ERP distinguishes between funds that are going on contract to a commercial vendor and funds being requested for intragovernmental transactions in the very first step of the funding document creation process. When creating a PR, a BFM at NAVAIR has the option of creating either a PR for the Standard Procurement System (ZSPS), or a PR for an intergovernmental funding document (ZFD). The “Z” in both acronyms is a code used internally by ERP to denote a command function.

1. ZSPS

A ZSPS PR is funding that will be put on contract with a commercial vendor. The “SPS” in the ERP command stands for “Standard Procurement System,” which is the automated information system (AIS) that contracting officers throughout the DOD use to write and generate contracts (NAWC: Training Systems Division Orlando, FL, 2015). While the contracting officer writes the contract in SPS, the BFM generates the required PR in ERP. Once the PR is approved by the comptroller, a ZSPS PR then automatically interfaces with SPS and the funding is attached to the contract. An illustration of this process is found in Figure 2.

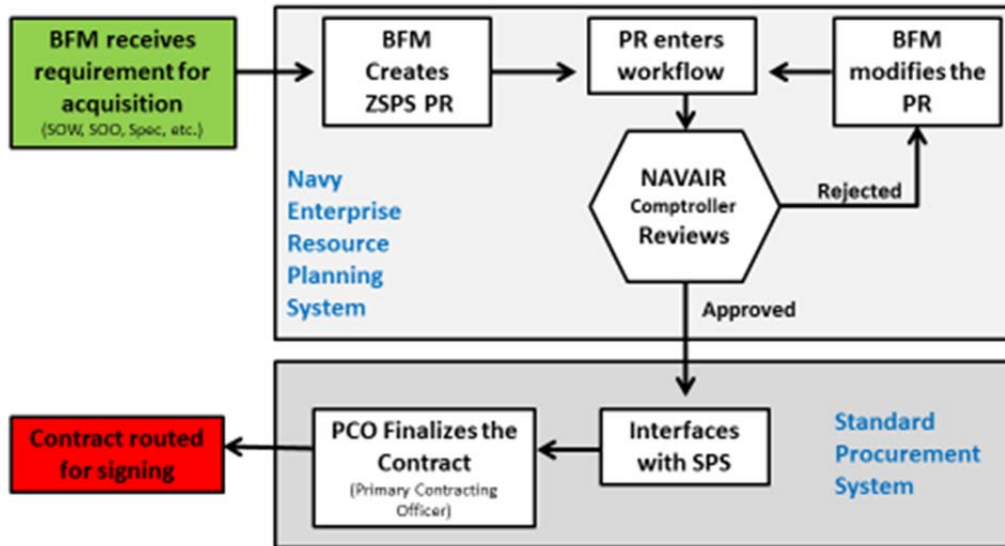


Figure 2. Simplified ZSPS PR Flowchart.
Adapted from NAWC: Training Systems Division Orlando, FL
(2013).

One of the defining characteristics of a ZSPS PR is that a single PR can be funded with different fiscal year, appropriation, and subhead combinations (NAVAIR, 2016). Because a contract has the ability to differentiate between funding sources with the use of separate Accounting Classification Reference Numbers (ACRNs), multiple types of funding can be placed on the same document. This differs from a ZFD that allows for only one appropriation of the same year per PR.

Another relevant difference between ZFDs and ZSPs are how each funding document uses the “Purchasing Group” field within the PR. While a ZFD has only two options for this field, one for reimbursable and one for direct cite, ZSPS PRs use the purchasing group to represent the Contract Specialist Group or “SPS Team Cabinet” that will perform the contract action. Because there is a purchasing group code for each of the SPS Team Cabinets at every major SYSCOM, for ZSPS PRs, these purchasing groups are many.

2. ZFD

A ZFD PR is used to fund an intergovernmental transaction. The “FD” in the ERP command stands for “Funding Document,” which is the generic term used to describe a transfer of Budget Authority from one government entity to another. Historically, there have been a number of different forms used to accomplish this end. Some of these forms include the “NAVCOMPT FORM 2275” for EAOs and POs, the DD FORM 448 for Military (and non-military) Interdepartmental Purchase Requests (MIPRS and IPRS), the NAVCOMPT FORM 2276 for work orders or direct cites, and the NAVCOMPT FORM 2276A for EAOs, POs, and direct cites (NAVAIR 10.3, 2016). With ERP, Navy BFM’s can now initiate and process each of these intragovernmental transactions all inside the ERP system. A breakdown of how the two most versatile and common of these forms, the DD FORM 448 and the NAVCOMPT FORM 2276, are employed is shown in Table 5.

Table 5. Breakdown of Intragovernmental Funding Documents.
Adapted from NAVAIR 10.3 (2016).

	DD Form 448		NAVCOMPT Form 2276A		
	MIPR	IPR	WX	PX	RX
COMMON NAME	Military Inter-Departmental Purchase Request	Inter-Departmental Purchase Request	Economy Act Order (WX)	Project Order (PO)	Direct Citation (RX)
TYPE	Reimbursable	Reimbursable	Reimbursable	Reimbursable	Direct Cite
ERP PURCHASE GROUP	H1F	H1F	H1F	H1F	H1D
RECIPIENT	Other DoD Services & Coast Guard	Non-DoD Agencies	Other Navy Activities	Other Navy Activities	Other Navy Activities
USE	Used for cross-service procurement and services between DoD agencies and the U.S. Coast Guard	Passes funding authority to non-DoD agencies (i.e., DOE, DOT, FAA, Library of Congress, etc.)	May be used as Economy Act Order or combination of an Economy Act Order and a direct citation document for request for contractual procurement (RCP)	May be used as Project Order or combination of an Project Order and a direct citation document for request for contractual procurement (RCP)	Used between Navy activities to place/request contracts for material services from a commercial vendor.

When a BFM at NAVAIR HQ creates a ZFD PR, the first half of the process is similar to the creation of a ZSPS PR. The BFM receives the requirement, creates the PR in Navy ERP, and submits to the comptroller for approval. However, once the comptroller approves the PR, the process differs. Because some receiving activities use Navy ERP, and others do not, a PR will follow one of two paths when it reaches this stage. The various paths for a ZFD PR are illustrated in Figure 3.

If the receiving activity uses Navy ERP, the PR will continue electronically through the Navy ERP system for review and, once agreed upon, approval by the receiving activity's comptroller. If the receiving activity does not use Navy ERP, the funding document will be printed, then faxed, scanned, mailed, or hand delivered to the comptroller of the receiving activity for review and approval. If approved, the receiving activity comptroller will sign and return to the NAVAIR HQ comptroller and funds will be obligated.

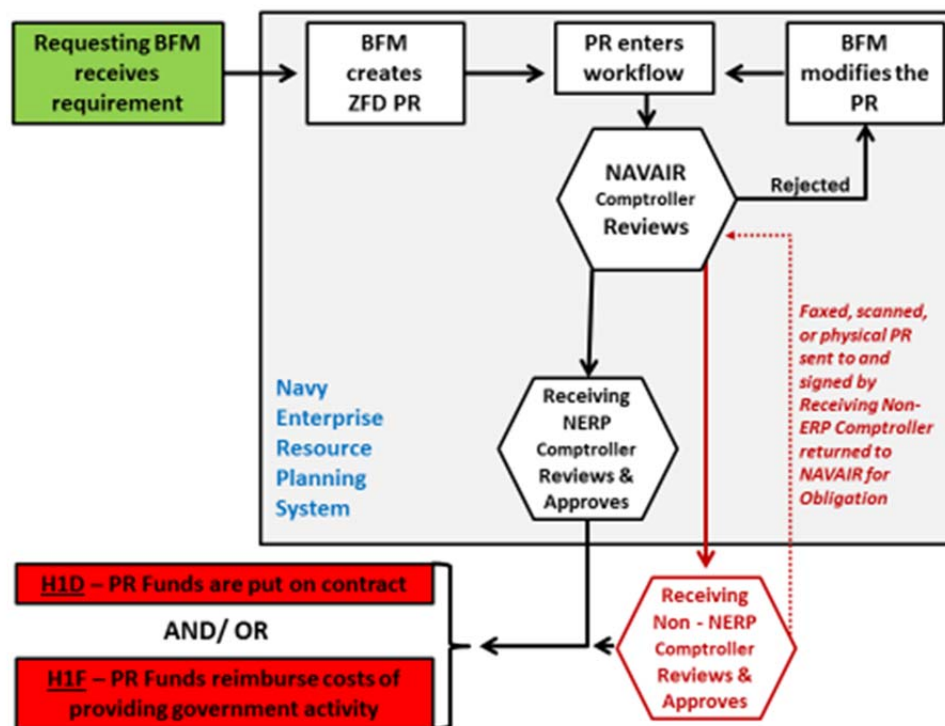


Figure 3. Simplified ZFD PR Flowchart.
Adapted from NAWC: Training Systems Division Orlando, FL (2013).

As discussed in the previous section on ZSPS PRs, ZFD PRs utilize the purchase group field within ERP differently. Once a NAVAIR BFM initiates the creation of a ZFD, there are only two options to choose from for the Purchasing Group category. These are H1F for a reimbursable, or H1D for a direct cite (NAVAIR 7.8, 2016). These purchasing group codes correlate the PR to one of the forms as illustrated in Table 5.

Whether the ZFD PR is a reimbursable or a direct cite, or the recipient activity uses Navy ERP or not, the fact remains that ZFD PRs require an additional level of review by government comptrollers that a ZSPS PR does not. Because ZFD PRs must be reviewed and approved on both the initiating and receiving ends by BFMs and Comptrollers, the creation of a ZFD PR generates twice the amount of work for NAVAIR that a ZPS PR normally would. This pegs ZFDs as a major workload driver for NAVAIR. In an effort to reduce the volume of these transactions NAVAIR Comptroller and Director of the Program and Business Analysis Office issued a joint memorandum on 20 December 2013 requiring that, “monthly metrics will be provided measuring the number of NAVAIR HQ basic R&D [Research and Development] and Procurement funding documents” (NAVAIR, 2013, para. 3). The purpose of the letter was to implement a policy to increase efficiency at the financial transaction level.

E. SUMMARY

This chapter presented an overview of the key organizations, processes, and concepts necessary to understand NAVAIR’s reimbursable funding document process. In it, we gave broad descriptions of NAVAIR and Navy ERP, an overview of how the Department of Defense (DOD) executes its budget, and finally, the rules governing funding document creation and processing at NAVAIR. Additionally, we identified reimbursable as a major workload driver within NAVAIR and the desire to reduce its numbers in order to create efficiencies at the financial transaction level. In the next chapter, we will review the methodology we employed in the data we collected from Navy ERP.

III. METHODOLOGY

A. INTRODUCTION

The methodology for this research project was developed in three phases. The first phase was data collection in which we determined how the data would be generated. The second phase was data analysis in which we filtered the data and determined how we would analyze it. The third phase was data analysis application in which we determined how we would apply the results of our data analysis.

B. DATA COLLECTION PHASE

Data for this research project was generated from purchase requests created by BFM's at NAVAIR. All of the data needed to create a purchase request is compiled in the Navy ERP system at NAVAIR. We coordinated with NAVAIR to retrieve the data we needed from the Navy ERP system. The raw data was then provided to us and consisted of purchase requests for NAVAIR financial transactions from FY2007–FY2017, totaling 984,768 transactions. Financial transactions in these fiscal years included obligations made against prior year appropriations and across multiple types of appropriations. Separately, NAVAIR provided us with the TOA they had for each program under its command.

C. DATA ANALYSIS PHASE

The raw data collected in the previous phase was refined in order to obtain a coherent and manageable data set. On the advice of NAVAIR, all transactions prior to FY2012 were removed; prior to 2012, the Navy ERP system had not been fully implemented at NAVAIR. Additionally, transactions from FY2017 were removed because, having received our data during FY2017, it did not represent a complete fiscal year.

The remaining five fiscal years of transactions still had several types of transactions that were not relevant to the research and were excluded from our analysis. These included transactions that had been initiated by a command other than NAVAIR,

transactions that had been flagged as a deletion in Navy ERP but had not been removed from the system, transactions that occurred against appropriations other than Procurement, RDT&E, and OMN/R, and transactions involving FMS. All transactions that had a blank Fund and Fund Center were discarded because they could not be associated with a specific activity. Any transactions that were against an expired appropriation also were removed. A full breakdown of the transactions removed can be found in Table 6.

Table 6. Filters Applied to Original Raw Data Set

FILTERED LINES OF DATA		
Steps	TOTAL RAW LINES	984,768
1	Filter out PRLI marked with 'Deletion Flag'	89,014
2	Filter out Non - HQ01 'Plants'	55,573
3	Filter out all FMS	92,750
4	Filter out All Non-Relevant APPNs	26,381
5	Filter out all BLANK Funds	202,337
6	Filter out all Customer Reimbursable "R" Funds	16,080
7	Filter out all ZFD Project Codes other than H1D & H1F	131
8	Filter out All NATEC Transactions (190N)	3,079
9	Filter out PRLI w/o Requisition , Approval, or PO Date	2,021
10	Filter out all APPN's prior to FY10	236,152
11	Filter out all APPN's after FY16	4,216
12	Filter out all Transactions occurring prior to FY12 (20111001)	71,268
13	Filter out all Transactions occurring after FY16 (20160930)	1,108
14	Filter out all Expired Procurement APPNs for each Active Year (FY12, 13, 14, 15, 16) respectively	502
15	Filter out all Expired RDT&E APPNs for each Active Year (FY12, 13, 14, 15, 16) respectively	82
16	Filter out all Expired OMN/R APPNs for each Active Year (FY12, 13, 14, 15, 16) respectively	829
TOTAL LINES OF DATA USED IN ANALYSIS		183,245

All of the data refining resulted in the removal of 801,523 transactions, with 183,245 transactions remaining to be analyzed. The remaining data consisted of transactions from FY2012–FY2016 with a collective value of \$146,248,562,568. These

transactions consisted of only PRs initiated within the NAVAIR organization against active year appropriations for Procurement, RDT&E, and OMN/R.

NAVAIR's main issue was the administrative burden created with the generation of each new PR. Therefore, we focused our analysis on the creation of PRs, looking for ways to reduce the number created as well a better understanding of what drives their creation. PRs that have amendments made to them go through the same administrative review process as basic PRs. Hence, we analyzed the number of amendments made on each basic PR to see what types led to the most amendments. We also analyzed the number of PRLI on each PR and computed it as a ratio. This ratio was calculated for every transaction and then averaged based on type of appropriation to create a benchmark. Finally, we analyzed the relationships between PRs and factors such as TOA, TDE, and median transaction value relative to TOA. The analysis of these relationships was conducted using simple linear regression.

D. DATA ANALYSIS APPLICATION PHASE

The data analysis conducted in the previous phase was applied to the program offices under NAVAIR's command. The ratio of PRLI to PR discussed in the previous phase was calculated for every NAVAIR program office. This was done by considering only financial transactions that occurred within a specific program office. Then, these calculated ratios were used to compare each program office to the benchmark created in the previous phase.

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IV. ANALYSIS OF NAVAIR FUNDING DOCUMENTS

This chapter details the analysis of data and its application used to address the research questions. This is accomplished in three stages, via an understanding of the behavioral characteristics of PRs at NAVAIR, the development of metrics and benchmarks for NAVAIR program office performance, and the application of simple linear regression analysis to determine both current and future adherence to the established benchmarks.

To organize the raw data generated from NAVY ERP, we focused on the most recent five fiscal years of complete NAVAIR financial transaction data, beginning the first day of FY2012 (1 October 2011) and ending the last day of FY2016 (31 September 2016). To align our analysis with NAVAIR's policy letter, addressing a reduction in basic RDT&E and procurement funding documents, we concentrated our efforts toward those specific appropriation categories (NAVAIR, 2013). Additionally, we drew distinctions between "Basic" PRs and the "Follow-On Amendments" they ultimately generate.

Finally, we focused our analysis on ZFD PRs. Due to the nature of ZFD PRs, the added workload they create and NAVAIR's desire to reduce them, insight into these intragovernmental transactions provide the best possible opportunity to achieve new PR processing efficiencies. Because one ZFD creates twice the amount of work for NAVAIR comptrollers than does one ZSPS, a concentration on ZFDs forms the basis of the following analysis.

Unless otherwise stated, the appropriation categories discussed in the following section consist of all procurement and RDT&E accounts owned by NAVAIR. While RDT&E is a category that stands on its own, procurement is comprised of four separate accounts: APN, WPN, OPN, and PANMC. As illustrated in Tables 12 through 15 in the Appendix, the percentage split between these appropriations remains relatively the same regardless of PR or PRLI type (ZSPS, H1D, or H1F), or whether discussing basic PRs, or

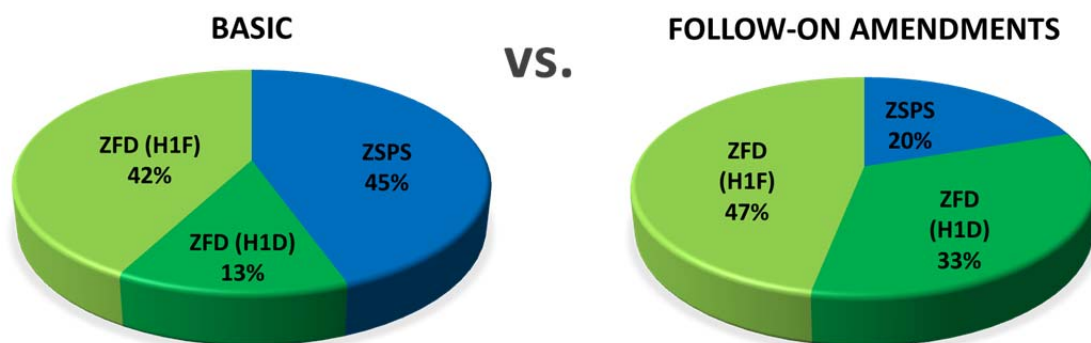
follow-on amendments. On average, NAVAIR spends 53% of its TOA on APN appropriations, 3% on WPN, 7% on OPN, 4% on PANMC, and 34% on RDT&E.

A. BEHAVIORAL CHARACTERISTICS OF NAVAIR PRS

In this first section, we analyze the data to gain insight into the behavioral characteristics of NAVAIR PRs. We then illustrate how these insights can be practically applied. With a better understanding of ERP financial transaction data, NAVAIR leadership will be better equipped to influence trends over time.

1. Data Analysis

The first step in our analysis was to establish a firm understanding of the behavioral characteristics of PRs at NAVAIR. By analyzing individual financial transactions, generated from the Navy ERP System, we were able to develop insights into NAVAIR business practices. To best understand these practices, we organized all investment appropriation categories into “basic” and “follow-on amendments.” We then distinguished between PRs going to a commercial vendor (ZSPS) and intragovernmental transactions (ZFDs), further dividing ZFDs by their purchase group: “H1D” for direct cites, and “H1F” for reimbursable. The average number of PRs at NAVAIR for FY2012–FY2016 is illustrated in Figure 4.



Percentages represent the average number of Investment APPN PRS from FY2012–FY2016.

Figure 4. Number of Basic PRs vs. Amendments

Basic investment appropriation PRs are split nearly evenly between ZSPS and H1F ZFDs with a 45% to 42% split, with H1D ZFDs making up the remaining 13%. The individual yearly totals for both ZFD purchase groups are randomly clustered around their five-year averages of 3,370 for H1F and 1,059 for H1D. Inversely, ZSPS PRs have been trending slightly higher each year since FY2013. Down from 3,661 in FY2012, ZSPS PRs have steadily increased year after year from 3,138 in FY2013 up to a new high of 3,800 in FY2016. See Table 12 in the Appendix.

These five-year average percentage splits differ greatly when calculating follow-on amendments. While H1F ZFDs remain relatively unchanged, up just 5% from 42% of basic PRs to 47% of amendments, H1D ZFDs grow drastically from 13% of basics up to 33% of all follow-on amendments. This growth in H1D ZFDs is made possible by the large reduction in the percentage of ZSPS, down from 45% of basics to just 20% of follow-on amendments. Similar to their basic counterparts, the individual yearly totals for both ZFD purchase groups are randomly clustered around their five-year averages of 1,653 for H1F and 1,176 for H1D. Likewise, ZSPS amendments also mimic the growth trend seen in basic PRs despite now only comprising 20% of the overall pie. ZSPS follow-on PRs have steadily increased year after year from 615 in FY2013 up to a new high of 762 in FY2016. See Table 13 in the Appendix.

2. Data Analysis Application

The application of this analysis provides three insights into the behavioral characteristics of NAVAIR PRs. They are as follows:

1. Despite comprising 45% of all total basic PRs at NAVAIR, ZSPSs only account for 20% of all follow-on amendments. This suggests that when a ZSPS PR is initially created, it is done correctly and for the full amount necessary to fund the contract action to which it is attached. Coordinating ZSPS funding for a contract with a commercial vendor (as highlighted in Figure 2), is a complicated process with multiple stakeholders. Once a contract is written, it can be a painstaking process to amend it.

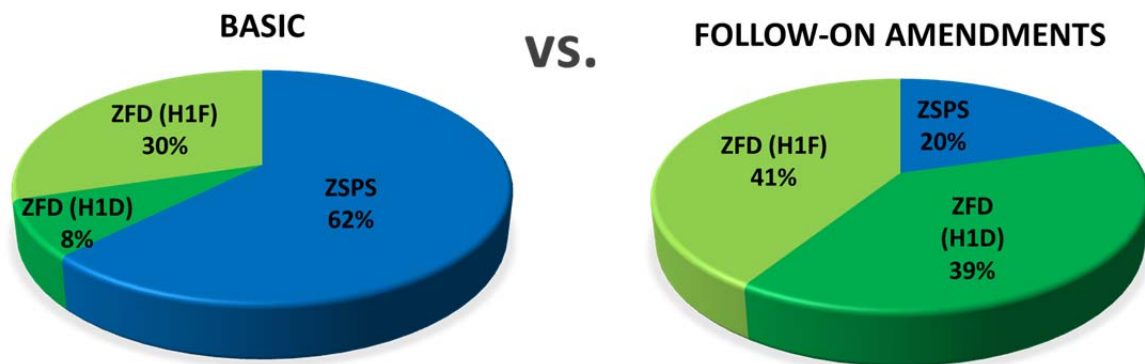
2. On average, 55% of all total basic PRs at NAVAIR are ZFDs consisting of both H1F & H1D. However, this 55% then leads to the majority of all follow-on amendments, resulting in 80% of all amendments. This suggests the inverse of the trend seen with their ZSPS counterparts. Because ZFDs are easy to create and add money to, there is little incentive to obligate the correct and full amount of funds initially on the basic. Particularly, H1D ZFDs are the biggest offender with an increase of 20% between the number of basics and the follow-on amendments they produce. Because a direct citation of funds is essentially the use of another government activities contracting vehicle, it is easy to obligate funds in this manner with minimal effort on behalf of the fund owner. Overall, ZFDs provide a quick and easy way to obligate money in order to increase or maintain compliance with OSD's Execution Benchmarks as illustrated in Table 2.
3. Lastly, the analysis of this data can be applied to gauge the effectiveness of NAVAIR's 2013 policy letter directing the reduction of basic R&D and procurement funding documentation. Issued on 20 December 2013, a few months into FY2014, analysis should show a decrease in the overall number of procurement and R&D ZFD PRs beginning in FY2014 and continuing even more dramatically into FY2015. Because the bulk of basic PRs are created in the first few months of the fiscal year, FY2014 could be too early to show the effects of the letter. Rather, if adhered to, FY2015 would be the best year to illustrate such a change. That said, the results are discouraging. While H1Ds decreased by 85 between FY2013 and FY2014, and then 119 between FY2014 and FY2015, they increased back up to 1,030 in FY2016, just 94 PRs fewer than their FY2013 pre-letter level of 1,124. Similarly, H1Fs decreased by 63 between FY2013 and FY2014, and then 120 between FY2014 and FY2015, only to increase by 221 to reach a four-year high of 3,362 in FY2016. See Table 12 in the Appendix.

B. METRIC AND BENCHMARK DEVELOPMENT

In the second part of our analysis, we build on the behavioral characteristics we explored above and use them to develop metrics that could be used to gain efficiencies in the processing of financial transactions. We then illustrate how these metrics can be practically applied to develop benchmarks of performance. With these newly developed metrics and benchmarks, NAVAIR leadership will be better able to track and hold its program offices accountable.

1. Data Analysis

The second step in our analysis builds on the understanding of the behavioral characteristics of NAVAIR PRs that we already developed. Adding to the insights gained by analyzing the difference between ZSPS and ZFD behaviors based on whether a PR is basic or an amendment, this section attempts to develop a reliable metric with which to benchmark NAVAIR program office PR creation efficiencies. To do this, we took a close look at the PRLIs that compose a PR. To parallel the information illustrated in Figure 4, we substituted PRLI for PR to gain insight into the average number of PRLIs at NAVAIR for FY2012–FY2016, comparing PRLIs on basic PRs versus PRLIs on follow-on amendments.



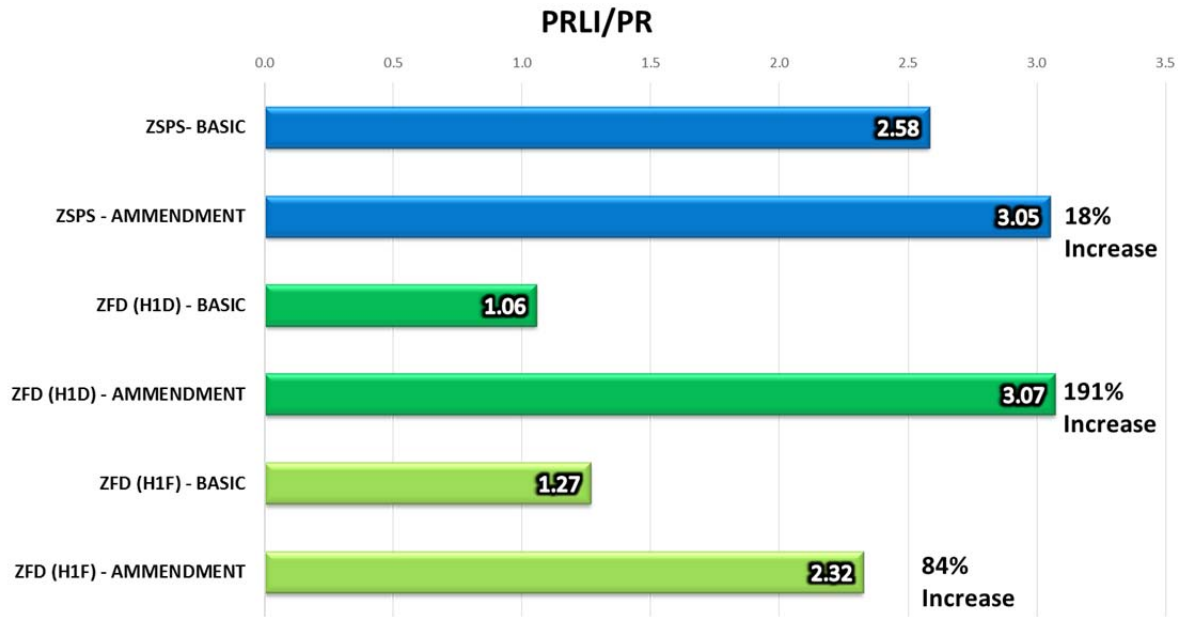
Percentages represent the average number of Investment APPN PRS from FY2012–FY2016.

Figure 5. Number of Basic PRLI vs. Amendments

PRLIs on basic ZSPS PRs greatly outnumber the PRLIs placed on basic ZFD PRs. While 62% are ZSPS, only 38% are ZFDs. Of this 38%, 30% are H1F ZFDs and a mere 8% are H1D. These five-year average percentage splits differ greatly when calculating follow-on amendments. While H1F ZFDs remain relatively unchanged, up just 11% from 30% of basic PRLIs to 41% of amendments, H1D ZFDs grow drastically from 8% of basics up to 39% of all follow-on amendments. Inversely, the numbers of ZSPS PRLIs on follow-on amendments drop from 62% down to just 20%. The annual PRLI totals, along with a breakout of each document type by appropriation category are illustrated in Table 14 and 15 of the Appendix.

These percentage changes support the evidence of analysis of PRs illustrated in Figure 4. Unlike ZSPSs, ZFDs are easy to amend, creating little incentive for BFM's to initially obligate the correct and full amount of funds on the basic. Rather it is easier, albeit less efficient, to use follow-on amendments to add PRLIs and make any necessary adjustments and corrections.

This analysis identified the average number of PRLIs per PR as a potential metric that could be used to gain efficiencies in the processing of ZFD PRs. By increasing the number of line items on a PR, fewer PRs would be required to fund the same amount of work. Analyzing this metric for each document type, as is illustrated in Figure 6, we see that ZFDs represent the biggest increase of PRLIs from basic to their follow-on amendment counterparts.



Numbers in white represent the ratio of average number of Investment APPN PRLIs per PR from FY2012–FY2016.

Figure 6. Average Number of PRLI per PR

While amendments to basic PRs can be expected, the average number of PRLI per PR ratio illustrates the drastic difference between ZSPS and ZFDs. Due to the complexity of contracting with commercial vendors; BFM ensure all possible required line items are included on the basic ZSPS, thus resulting in an average ratio of 2.58. Because there are inevitably changes that need to be made when contracting, this ratio increases only 18% to 3.07 for ZSPS follow-on amendments.

ZFDs, on the other hand, increase much more radically due to the fact they initially put so few line items on their basic PRs. H1F ZFDs increase 84% from a ratio of 1.27 on basics to 2.32 on follow-on amendments. This increase is nearly doubled with H1D ZFDs. Growing from a ratio of 1.06 on basics to 3.07 on amendments; H1D ZFDs exhibit the largest increase of 191% in the number of PRLIs per PR, almost tripling in quantity.

2. Data Analysis Application

The application of the PRLI/PR metric provides insight into how efficiently BFM's are creating PRs. The forced efficiency of ZSPS PRs that results from the complex nature of commercial contracting provides a benchmark that BFM's should strive to imitate when creating basic ZFDs. By increasing the number of line items on a basic ZFD PR, fewer PRs should be required to fund the same amount of work. An increase of 191% as seen in H1D ZFDs begs the question as to why the PRLIs placed on follow-on amendments could not be better planned to go on the basic, thus eliminating the need for the amendment and decreasing comptroller workload.

Because ZSPS PRs and ZFD PRs are inherently different, a better benchmark might be derived from applying the "average number of PRLIs per PR" ratio of a specific program to that of its peers. Figure 7 compares the NAVAIR activities that put the most line items on a basic ZFD PR to those activities that put the least amount of line items on a basic ZFD PR, broken out by procurement appropriations and RDT&E.

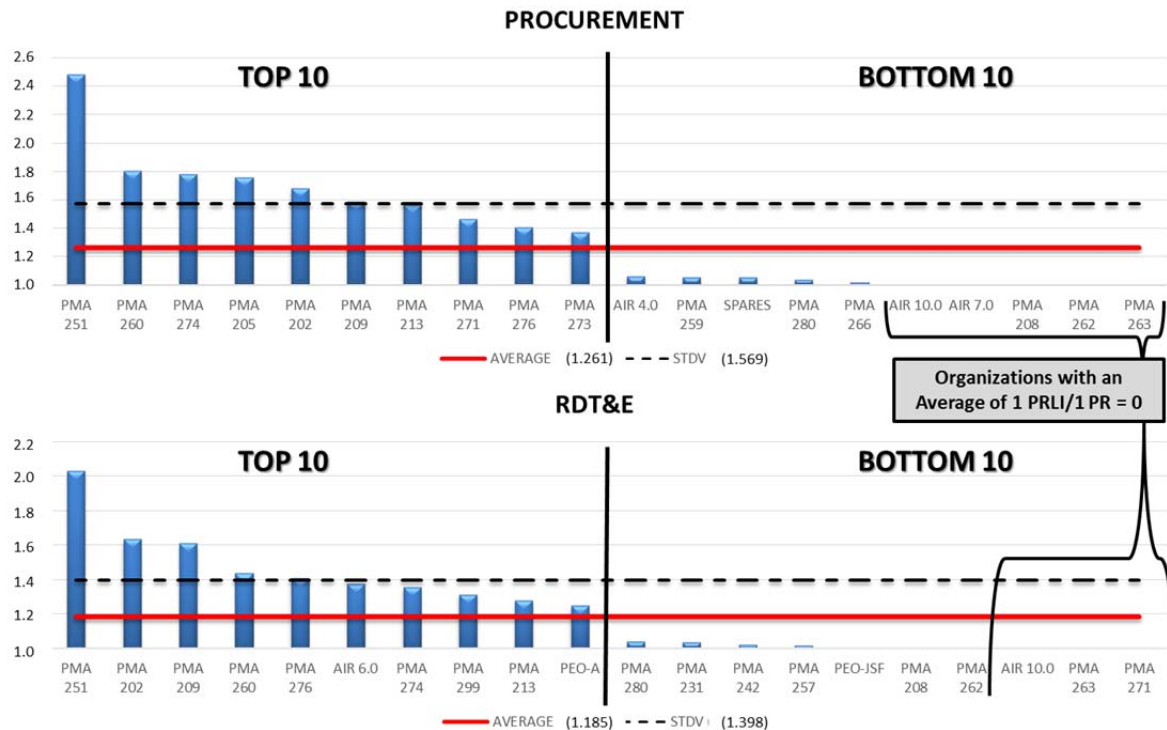


Chart created using mean number of basic investment APPN ZFDs FY2012–FY2016.

Figure 7. Top 10 and Bottom 10 NAVAIR Activities Ranked Using the PRLI/PR Ratio

By graphing each NAVAIR activity by the average number of PRLIs they put on a PR we can gain a better understanding of its funding document creation processes. With each activity graphed, we are then able to use the mean and standard deviation as benchmarks to determine who the top performers are and who the worst offenders are.

For example, the average number of procurement PRLIs per PR is 1.261 and the standard deviation is 1.569. Armed with this information, we can now see that there are five activities whose mean number of PRLIs per PR is above the standard deviation. Best practices could potentially be extrapolated from the funding document creation process of these five activities. Likewise, corrective actions could be taken on those using its PRLIs least effectively. The same is true for the top and bottom offenders for the RDT&E appropriation. A full list of NAVAIR activities ranked from highest to lowest based on their mean number of PRLIs per PR is found in Table 16 of the Appendix.

C. SIMPLE LINEAR REGRESSION ANALYSIS

Simple linear regression looks for a linear relationship between a dependent and independent variable. The Ordinary Least Squares method was used in this thesis. The intent of this research is focused on reducing the number of PRs created annually. Therefore, it used simple linear regression to look for independent variables that had a statistically significant relationship with PRs.

1. Data Analysis

Two dependent variables were used in the analysis: Number of PR and the calculated metric number of PRLI per PR. Only ZFD PRs were considered in the data analysis since the primary goal of this research was to analyze internal PRs. Likewise, only basic PRs were considered in the data analysis since they are the driver of follow-on amendments. Several independent variables were analyzed to determine if they were statically significant. However, only two independent variables—Total Obligation Authority and total dollars executed—were determined to have a statically significant relationship with the dependent variables. Summary statistics of the variables used in the regressions that had a statistically significant relationship before removal of outliers are shown in Table 7.

Table 7. Summary Statistics for Regressions with a Statistically Significant Relationship

<u>Variable</u>	<u>Mean</u>	<u>Standard Deviation</u>	<u>Minimum</u>	<u>Maximum</u>	<u>Observations</u>
PR on TOA					
<u>ZFD - Procurement</u>					
# PR per FUND	25.48	36.00	1	247	577
TOA	\$207,480,669	\$439,624,255	\$17,903	\$2,973,762,600	577
<u>ZFD - RDT&E</u>					
# PR per FUND	18.95	18.59	1	114	369
TOA	\$81,852,214	\$166,634,194	\$169,000	\$1,281,176,246	369
<u>ZFD - OMN & OMNR</u>					
# PR per FUND	112.57	169.84	1	773	91
TOA	\$174,500,767	\$263,801,714	\$89,356	\$1,182,153,705	91
PR on TDE					
<u>ZFD-H1F Procurement</u>					
# PR per FUND	21.10	30.33	1	215	538
TDE	\$11,913,910	\$34,103,332	\$90	\$508,923,666	538
<u>ZFD-H1D Procurement</u>					
# PR per FUND	8.37	10.68	1	65	434
TDE	\$7,877,092	\$22,542,929	\$0	\$248,884,660	434
<u>ZFD-H1F RDT&E</u>					
# PR per FUND	15.25	15.10	1	102	361
TDE	\$8,717,604	\$17,639,776	\$553	\$188,374,662	361
<u>ZFD-H1D RDT&E</u>					
# PR per FUND	5.56	5.58	1	33	304
TDE	\$2,747,441	\$6,057,396	\$0	\$46,201,186	304
<u>ZFD-H1F OMN/R</u>					
# PR per FUND	95.93	153.52	1	686	90
TDE	\$40,011,047	\$109,584,547	\$121	\$610,929,079	90
<u>ZFD-H1D OMN/R</u>					
# PR per FUND	26.87	35.58	1	154	71
TDE	\$4,273,144	\$7,393,912	\$0	\$34,607,587	71
PRLI per PR on TDE					
<u>ZFD-H1F Procurement</u>					
# PRLI/PR	1.27	0.54	1	7.5	538
TDE	\$11,913,910	\$34,103,332	\$90	\$508,923,666	538
<u>ZFD-H1F RDT&E</u>					
# PRLI/PR	1.15	0.28	1	3.13	361
TDE	\$8,717,604	\$17,639,776	\$553	\$188,374,662	361
<u>ZFD-H1F OMN/R</u>					
# PRLI/PR	1.24	0.34	1	2.59	90
TDE	\$40,011,047	\$109,584,547	\$121	\$610,929,079	90

a. Number of ZFD PR Dependent on TOA

A simple linear regression was used to analyze the effect that the TOA of a program would have on the number of ZFD PRs created annually. The regression results for three types of appropriations are shown in Table 8. The intercept and independent variable “TOA” for all three regressions was statistically significant at the less than 1% level.

The intercept indicates the minimum number of ZFD PRs to expect given the type of appropriation. The independent variable “TOA” indicates the increase to the number of ZFD PR that should be expected for every \$10,000,000 increase in TOA. Equation (1) was used to conduct the simple linear regression for ZFD PR dependent on TOA,

$$PR_{i,t} = \beta_0 + \beta_1 TOA_{i,t} + \varepsilon_{i,t} , \quad (1)$$

where $PR_{i,t}$ is a dependent variable equal to ZFD PR i in time period t . The time period t for this equation represents one fiscal year. β_0 represents the intercept of the equation. The coefficient $\beta_1 TOA_{i,t}$ is an independent variable equal to TOA i in time period t . $\varepsilon_{i,t}$ is the error term in the equation.

Table 8. Regression Analysis for Number of ZFD PR Dependent on TOA

	(1)	(2)	(3)
	<u>ZFD - Procurement</u>	<u>ZFD - RDT&E</u>	<u>ZFD - OMN/R</u>
Intercept	17.0018*** (1.0392)	13.0839*** (0.8581)	29.7337*** (8.1321)
TOA ⁺	0.2377*** (3.21E-09)	0.6781*** (7.62E-09)	3.738*** (4.76E-08)
Observations	548	354	81
R ²	0.091	0.184	0.438

Notes: ***, **, * denote significance at the 1%, 5%, and 15% levels, respectively. Standard errors in parentheses. (+) TOA per \$10,000,000.

b. Number of H1F or H1D ZFD PR Dependent on TDE

A simple linear regression was used to analyze the effect that the TDE of a program would have on the number of H1F or H1D ZFD PRs created annually. The regression results for three types of appropriations split between H1F and H1D ZFD PRs are shown in Table 9. The intercept and independent variable “TDE” for all six regressions was statistically significant at the less than 1% level.

The intercept indicates the minimum number of H1F or H1D ZFD PRs to expect given the type of appropriation. The independent variable “TDE” indicates the increase to the number of H1F or H1D ZFD PR that should be expected for every \$1,000,000 increase in TDE. Equation (2) was used to conduct the simple linear regression for H1F or H1D ZFD PR dependent on TDE,

$$PR_{i,t} = \beta_0 + \beta_1 TDE_{i,t} + \varepsilon_{i,t}, \quad (2)$$

where $PR_{i,t}$ is a dependent variable equal to H1F or H1D ZFD PR i in time period t . The time period t for this equation represents one fiscal year. β_0 represents the intercept of the equation. The coefficient $\beta_1 TDE_{i,t}$ is an independent variable equal to TDE i in time period t . $\varepsilon_{i,t}$ is the error term in the equation.

Table 9. Regression Analysis for Number of H1F or H1D ZFD PR Dependent on TDE

	(1)	(2)	(3)	(4)	(5)	(6)
	<u>ZFD-H1F</u>	<u>ZFD-H1D</u>	<u>ZFD-H1F</u>	<u>ZFD-H1D</u>	<u>ZFD-H1F</u>	<u>ZFD-H1D</u>
	<u>Procurement</u>	<u>Procurement</u>	<u>RDT&E</u>	<u>RDT&E</u>	<u>OMN/R</u>	<u>OMN/R</u>
Intercept	8.701*** (0.7767)	5.6484*** (0.4207)	8.2942*** (0.6762)	3.6035*** (0.2377)	49.1568*** (7.6532)	15.6242*** (3.7022)
TDE ⁺	1.1082*** (5.67E-08)	0.3128*** (1.17E-08)	0.8589*** (6.09E-08)	0.6109*** (5.77E-08)	0.6798*** (1.73E-07)	1.8689*** (5.41E-07)
Observations	522	420	351	291	81	68
R ²	0.423	0.189	0.363	0.279	0.164	0.153

Notes: ***, **, * denote significance at the 1%, 5%, and 15% levels, respectively. Standard errors in parentheses. (+) TDE per \$1,000,000.

c. Number of PRLI per H1F ZFD PR Dependent on TDE

A simple linear regression was used to analyze the effect that the TDE of a program would have on the metric number of PRLI per PR. For this regression, the number of PRLI per H1F ZFD PRs created annually was specifically analyzed. The regression results for three types of appropriations are shown in Table 10. The intercept and independent variable “TDE” for H1F ZFD Procurement and OMN/R regressions was statistically significant at the less than 1% level. However, for H1F ZFD RDT&E regression the intercept was statistically significant at the less than 1% level while the independent variable “TDE” was statistically significant at the less than 15% level.

The intercept indicates the minimum number of PRLI per H1F ZFD PR to expect given the type of appropriation. The independent variable “TDE” indicates the increase to the number of PRLI per H1F ZFD PR that should be expected for every \$1,000,000 increase in TDE. Equation (3) was used to conduct the simple linear regression for PRLI per H1F ZFD PR dependent on TDE,

$$PRLI/PR_{i,t} = \beta_0 + \beta_1 TDE_{i,t} + \varepsilon_{i,t} , \quad (3)$$

where $PRLI/PR_{i,t}$ is a dependent variable equal to PRLI / H1F ZFD PR i in time period t . The time period t for this equation represents one fiscal year. β_0 represents the intercept of the equation. The coefficient $\beta_1 TDE_{i,t}$ is an independent variable equal to TDE i in time period t . $\varepsilon_{i,t}$ is the error term in the equation.

Table 10. Regression Analysis for Number of PRLI per H1F ZFD PR
Dependent on TDE

	(1)	(2)	(3)
	<u>ZFD-H1F Procurement</u>	<u>ZFD-H1F RDT&E</u>	<u>ZFD-H1F OMN/R</u>
Intercept	1.1813*** (0.0175)	1.1166*** (0.0147)	1.1275*** (0.027)
TDE ⁺	0.0035*** (1.07E-09)	0.0019* (1.24E-09)	0.0037*** (5.46E-10)
Observations	517	350	86
R ²	0.020	0.006	0.351

Notes: ***, **, * denote significance at the 1%, 5%, and 15% levels, respectively. Standard errors in parentheses. (+) TDE per \$1,000,000.

d. Regressions with No Evidence of a Statistically Significant Relationship

A list of other combinations of dependent and independent variables that were looked at during the course of this research can be found in Table 11. All of these regressions produced a relationship that was not statistically significant, meaning that the independent variable had no evidence of an impact on the dependent variable. Of note, the use of PR as the dependent variable and median dollar value of a PR divided by TOA as the independent variable was requested by NAVAIR and produced no evidence of a statistically significant relationship.

Table 11. Regressions with No Evidence of a Statistically Significant Relationship

<u>Type of PR</u>	<u>Dependent (Y)</u>	<u>Independent (X)</u>
ZFD - Procurement ⁺	PR	Median \$ Value/TOA
ZFD - Procurement	PR	Average \$ Value/TOA
ZFD - Procurement	PRLI/PR	TOA
ZFD - RDT&E ⁺	PR	Median \$ Value/TOA
ZFD - RDT&E	PR	Average \$ Value/TOA
ZFD - RDT&E	PRLI/PR	TOA
ZFD-H1D RDT&E	PRLI/PR	TDE
ZFD - OMN/R ⁺	PR	Median \$ Value/TOA
ZFD - OMN/R	PR	Average \$ Value/TOA
ZFD-H1D OMN/R	PRLI/PR	TDE

Notes: (+) Requested by NAVAIR. Regression results available upon request.

There were two regressions—not previously mentioned—in which the results did have a statistically significant relationship. Those were the relationships between PRLI / ZFD PR and TOA for OMN/R appropriations and between PRLI / H1D ZFD PR and TDE for Procurement appropriations. However, it was not clear what the application of these results would be given that PRs of a similar type for other appropriations did not have a statistically significant relationship. Additional research is likely needed to determine the validity and application of these relationships. The results of these regressions are available upon request.

2. Data Analysis Application

The results of the data analysis conducted on the relationship between number of PR and TOA can be applied at the beginning of the FY to estimate the number of basic ZFD PRs. This is done by taking the TOA for the FY and using the appropriate regression equation provided in Table 8. This tool will allow NAVAIR to have a strong understanding of how many basic ZFD PRs to expect from a program at the end of the FY. Using that estimate, they can monitor a program's progress throughout the FY to see

how they track against the estimate. However, these equations cannot be used to predict the makeup of ZFDs between H1F and H1D over the course of the FY.

The results of the data analysis conducted on the relationship between number of basic PR, PRLI/PR and TDE can be applied to monitor a programs progress during and at the end of the FY. By knowing the TDE, and using the regression equations provided in Table 9, the approximate number of H1F or H1D ZFD PRs for a FY can be estimated. This provides NAVAIR with another tool to monitor the programs under its purview. By taking the TDE for a program at any point in the FY, they can generate an estimate of how many PRs, H1F or H1D ZFD, a program should have. If a program is above the estimated number increased scrutiny can be applied. This will also work for looking at the metric of PRLI/PR but only for determining the number of H1F ZFD PRs, equations provided in Table 10.

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V. CONCLUSIONS, RECOMMENDATIONS, AND AREAS FOR FURTHER RESEARCH

The creation, processing, and execution of funding documents are a significant contributor to the workload of BFM's and comptrollers at NAVAIR. In particular, intragovernmental transactions, administered as "ZFDs" in Navy ERP, demand twice the amount of comptroller effort as a ZSPS, which puts funding on contract with a commercial vendor. Unlike a ZSPS, a ZFD requires review and approval by two separate comptrollers; first on the requesting end by comptrollers at NAVAIR HQ, and then by the comptrollers of the government activity providing the good or performing the work requested. As such, there is a need at NAVAIR to reduce the number of these intragovernmental transactions.

Conducted at the request of NAVAIR 7.8, Program and Business Analysis Office, this research seeks to assist NAVAIR in this effort. By analyzing historical, objective, and repeatable financial transaction data generated from Navy ERP, this report provides insight into NAVAIR business practices, develops a metric with which to gauge efficiency and benchmark performance, and provides a few simple linear regression equations to determine adherence to the newly established benchmarks over time.

The results of this analysis will help NAVAIR work towards reducing the number of funding documents generated annually. In turn, this will then ultimately reduce the administrative burden on its Comptrollers and BFM's, thereby increasing the overall efficiency of the organization as a whole. Additionally, this research will help to begin the study of Navy ERP data and follow-on research at other Naval System Commands. The following sections review the conclusions and resulting recommendations as they relate to the original research questions and concludes with a section detailing the areas of further research that could potentially add value to NAVAIR, but were out of scope for this report.

A. CONCLUSIONS

1. How can financial transactions, generated from the Navy ERP System, be analyzed to provide insight into NAVAIR business practices?

The application of basic descriptive statistical analysis and simple linear regressions on large data sets generated from Navy ERP can provide volumes of valuable insights to NAVAIR. Because Navy ERP has only relatively recently been adopted as the Department of the Navy's financial system of record, officially deployed at NAVAIR in 2007, it is just now finally at the point of being able to produce enough years of reliable historical data suitable for detailed analysis.

Each financial transaction generated in Navy ERP, whether it is a ZSPS or ZFD PR, carries with it a wide array of information. This information details everything that needs to be known about that specific transaction. To narrow the scope of our research, we focused on a select few points of data that allowed us to observe trends and provide insight into the specific issue of how to reduce the number of intragovernmental funding documents. However, the amount of data available in these financial transactions has the potential to provide countless other insights into the way NAVAIR spends its money.

2. What metrics can be developed to measure the performance of NAVAIR program offices?

With the ultimate goal of reducing the number of funding documents that NAVAIR program offices send to other intragovernmental activities, we focused our attention on a metric that would work toward such an end. Through statistical analysis, we observed that while ZFDs comprised only 55% of all basic PRs, they allotted for over 80% of all follow-on amendments. Likewise, an analysis of PRLIs showed that while only 38% of PRLIs on basic PRs were ZFDs, they comprised over 80% of follow-on amendments. This increase is amplified when viewed at the purchase group level. H1Ds and H1Fs increase 191% and 84%, respectively, from basics to amendments.

By increasing the number of PRLI placed on a ZFD PR, fewer PRs would be required to fund the same amount of work. A BFM could reduce the number of follow-on amendments by increasing the number of PRLIs they place on a single basic PR.

Each time a program office generates a funding document, it creates work at each level of the approval chain, diverting scarce resources—time and personnel—away from other vital program requirements. By developing and implementing such a metric as the PRLI/PR ratio, NAVAIR could reduce the number of these extraneous follow-on amendments and use it to measure the performance of the program offices at NAVAIR.

3. How can these metrics be applied to identify the program offices currently implementing the best practices in order to assist NAVAIR senior leadership in directing future funding document behavior?

By applying the PRLI/PR ratio as a metric to NAVAIR program offices, leadership could then determine which program offices are actively working to decrease the number of transactions they generate in the system, thereby decreasing workload and bolstering efficiency throughout NAVAIR. By analyzing these top performers and implementing the business practices that enable them to minimize transactions in other, less efficient program offices, NAVAIR senior leadership will be able to direct future funding document behavior and influence trend lines over time.

4. What should be the benchmarks of performance related to the purchase request process within NAVAIR program offices?

When the PRLI/PR metric is applied to all NAVAIR spending activities, descriptive statistics can be used to develop benchmarks of performance related to the PR process within NAVAIR program offices. Using the five-year average of FY2012 to FY2016 on basic procurement PRs, we are able to calculate a mean PRLI/PR of 1.261 and a standard deviation of 0.308. These can then be used as benchmarks to order NAVAIR spending activities into above average and below average performers.

For example, as depicted in Figure 7, there are five program offices with PRLI/PR ratios above the standard deviation of 1.569 for basic procurement ZFDs. The business practices of these five program offices should be studied in order to develop a list of best practices that could be implemented across NAVAIR to improve overall efficiency in the creation of funding documents. Likewise, another study should be conducted to determine why the activities with PRLI/PR ratios well below the mean of 1.261 are under performing.

B. RECOMMENDATIONS

We recommend that NAVAIR begin by reviewing the insights provided in chapter IV section A2. This will help them better understand the current behavioral characteristics of their PRs. This information could also help to determine areas that require further internal scrutiny or study. Immediate steps that might be taken to improve business practices include:

- An internal review of the process for drafting ZFD PRs, looking for ways to improve the basic PR and reducing the number of follow-on amendments.
- Updating and re-releasing the 2013 letter regarding NAVAIR's policy on funding documents or releasing a new instruction.
- Using the regression analysis to estimate the expected number of basic ZFD PRs in a FY and monitoring PMAs against that estimate.

We further recommend that NAVAIR implement the use of the PRLI to PR metric to monitor their PMAs. By working to increase the number of line items on a basic ZFD PR, fewer PRs should be required to fund the same amount of work. This metric will allow NAVAIR to reduce their workload while monitoring PMA performance. Additional actions that will help in the implementation of the metric include:

- Defining the PRLI/PR benchmarks that PMAs will be measured against.
- Conducting a review of the business practices at program offices that have the highest calculated ratio of PRLI/PR to gain insights for improvement.
- Using the regression analysis to estimate the expected number of PRLI on a basic H1F ZFD PRs in a FY and monitoring PMAs against that estimate.

C. AREAS FOR FURTHER RESEARCH

The first proposed area of further research would be to use the tools developed in this report to conduct an in depth review of the program offices at NAVAIR. This review would determine the best practices implemented by the top performers. Currently, at NAVAIR, there is a policy letter that seeks to, "increase efficiency at the financial

transaction level by reducing the number of basic R&D and Procurement funding documents,” and ensure that monthly metrics will be provided to accomplish this end (NAVAIR, 2013, para. 1). However, no metrics were ever developed. The best practices identified in this review could be formally organized and added to this letter to measure adherence to NAVAIR policy and influence trend lines over time.

A second area of further research would be to apply the methods developed in this report to the business practices of other Navy Systems Commands. These findings could then be compared to NAVAIR, initiating a dialogue between SYSCOMS that could potentially lead to increased efficiencies for all. For example, NAVAIR H1D ZFDs currently exhibit a 191% increase in the number of PRLIs/PR from basics to amendments. Is such an increase consistent across all Navy SYSCOMS, or is NAVAIR an outlier? Such a comparative study would put the findings of this report into context with the performance of the larger Navy.

Lastly, the ability to extract such vast quantities of detailed financial transaction data from Navy ERP combined with a statistically significant segment of years in which ERP has reliably been used as the Navy’s financial system of record, has created a unique opportunity to gain new and interesting insights into the Navy’s business practices. Due to the limited scope of our report, we focused our attention on just a few of the many data points that were originally included in the Navy ERP generated data set. The same could be done for other aspects of financial transaction data.

For example, one possibility is a detailed spend-plan review of all NAVAIR program offices. Using the Object Class and Material Group codes embedded in each financial transaction, a report could be generated detailing exactly what type of goods and services each PMA is purchasing. This information could be compared to the timeframe of when the purchases are made, what type of funding document were used to purchase them, and who the vendor was. Such a report would provide valuable insight to NAVAIR leaders to help them better understand the business practices of its program offices. The possibilities are endless.

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APPENDIX. EMPIRICAL DATA

Table 12. Number of Basic Investment Appropriation PRs

	2012	2013	2014	2015	2016	5 YR AVERAGE	PERCENT
ZSPS	3661	3138	3470	3710	3800	3555.8	45%
APN	2009	1748	1841	1991	1866	1891	53%
WPN	105	95	96	115	105	103.2	3%
OPN	209	175	192	254	290	224	6%
PANMC	43	31	135	145	111	93	3%
RDTE	1295	1089	1206	1205	1428	1244.6	35%
H1D	1183	1124	1039	920	1030	1059.2	13%
APN	737	666	634	467	490	598.8	57%
WPN	28	27	14	15	13	19.4	2%
OPN	53	52	46	49	47	49.4	5%
PANMC	65	105	37	37	25	53.8	5%
RDTE	300	274	308	352	455	337.8	32%
H1F	3762	3324	3261	3141	3362	3370	42%
APN	1976	1724	1728	1545	1671	1728.8	51%
WPN	151	110	117	101	96	115	3%
OPN	319	363	303	310	279	314.8	9%
PANMC	115	105	114	100	118	110.4	3%
RDTE	1201	1022	999	1085	1198	1101	33%

Table 13. Number of Follow-On Investment Appropriation Amendment PRs

	2012	2013	2014	2015	2016	5 YR AVERAGE	PERCENT
ZSPS	693	615	681	724	762	695	20%
APN	317	312	336	351	372	337.6	49%
WPN	33	21	39	35	45	34.6	5%
OPN	59	46	36	49	42	46.4	7%
PANMC	15	16	21	18	22	18.4	3%
RDTE	269	220	249	271	281	258	37%
H1D	1443	1197	1097	1011	1133	1176.2	33%
APN	909	718	653	527	536	668.6	57%
WPN	49	33	22	15	18	27.4	2%
OPN	71	68	54	59	60	62.4	5%
PANMC	82	106	39	46	37	62	5%
RDTE	332	272	329	364	482	355.8	30%
H1F	1707	1544	1700	1551	1765	1653.4	47%
APN	804	782	851	743	864	808.8	49%
WPN	72	63	75	53	65	65.6	4%
OPN	148	167	160	157	164	159.2	10%
PANMC	54	50	57	52	43	51.2	3%
RDTE	629	482	557	546	629	568.6	34%

Table 14. Number of PRLIs on Basic Investment APPN PRs

	2012	2013	2014	2015	2016	5 YR AVERAGE	PERCENT
ZSPS	8342	7164	9380	9270	10749	8981	63%
APN	5597	4852	5621	6042	6598	5742	64%
WPN	356	299	441	371	343	362	4%
OPN	672	506	1385	954	1592	1021.8	11%
PANMC	62	51	318	263	250	188.8	2%
RDTE	1655	1456	1615	1640	1966	1666.4	19%
H1D	1237	1180	1104	965	1105	1118.2	8%
APN	787	715	687	498	526	642.6	57%
WPN	30	27	14	15	14	20	2%
OPN	53	56	48	54	51	52.4	5%
PANMC	66	105	45	45	49	62	6%
RDTE	301	277	310	353	465	341.2	31%
H1F	4446	4082	4259	4139	4415	4268.2	30%
APN	2429	2194	2285	2139	2275	2264.4	53%
WPN	152	111	123	110	110	121.2	3%
OPN	409	484	547	509	477	485.2	11%
PANMC	138	129	140	127	149	136.6	3%
RDTE	1318	1164	1164	1254	1404	1260.8	30%

Table 15. Number of PRLIs on Follow-On Investment APPN Amendments

	2012	2013	2014	2015	2016	5 YR AVERAGE	PERCENT
ZSPS	1708	1572	1625	1964	1886	1751	20%
APN	915	858	862	1034	990	931.8	53%
WPN	63	41	91	109	104	81.6	5%
OPN	130	124	79	137	125	119	7%
PANMC	35	29	34	43	54	39	2%
RDTE	565	520	559	641	613	579.6	33%
H1D	4690	3238	2778	2722	3086	3302.8	39%
APN	3067	1904	1765	1718	1749	2040.6	62%
WPN	174	89	86	73	65	97.4	3%
OPN	351	230	147	127	139	198.8	6%
PANMC	341	387	69	79	118	198.8	6%
RDTE	757	628	711	725	1015	767.2	23%
H1F	3425	3135	3429	3382	4166	3507.4	41%
APN	1631	1582	1693	1443	1987	1667.2	48%
WPN	118	102	109	94	131	110.8	3%
OPN	282	372	374	370	459	371.4	11%
PANMC	114	87	125	108	81	103	3%
RDTE	1280	992	1128	1367	1508	1255	36%

Table 16. PRLI/PR Ratio Ranking of All NAVAIR Activities

PROCUREMENT BASIC ZFDS (H1D & HIF)					RDT&E BASIC ZFDS (H1D & HIF)				
AVERAGE OF 5 YEARS (FY12-FY16)					AVERAGE OF 5 YEARS (FY12-FY16)				
Mean: 1.261		Standard Deviation: 0.308			Mean: 1.185		Standard Deviation: 0.213		
RANK	ACTIVITY	# OF PRS	# OF PRLI	PRLI/PR	RANK	ACTIVITY	# OF PRS	# OF PRLI	PRLI/PR
1	PMA 251	154	382	2.480519481	1	PMA 251	66	134	2.03030303
2	PMA 260	556	1001	1.800359712	2	PMA 202	49	80	1.632653061
3	PMA 274	91	162	1.78021978	3	PMA 209	195	314	1.61025641
4	PMA 205	673	1181	1.754829123	4	PMA 260	39	56	1.435897436
5	PMA 202	84	141	1.678571429	5	PMA 276	59	83	1.406779661
6	PMA 209	556	880	1.582733813	6	AIR 6.0	145	199	1.372413793
7	PMA 213	906	1415	1.561810155	7	PMA 274	138	187	1.355072464
8	PMA 271	285	416	1.459649123	8	PMA 299	163	214	1.312883436
9	PMA 276	539	758	1.406307978	9	PMA 213	300	383	1.276666667
10	PMA 273	262	358	1.366412214	10	PEO-A	4	5	1.25
11	PMA 207	538	714	1.327137546	11	PMA 273	25	31	1.24
12	PMA 272	615	793	1.289430894	12	PMA 205	110	135	1.227272727
13	PMA 275	516	629	1.218992248	13	PMA 272	271	331	1.221402214
14	PMA 290	1079	1313	1.21686747	14	PMA 265	354	418	1.18079096
15	PMA 265	1897	2301	1.212967844	15	PMA 275	151	174	1.152317881
16	PMA 201	470	562	1.195744681	16	PMA 281	183	208	1.136612022
17	PMA 264	47	56	1.191489362	17	PMA 201	339	378	1.115044248
18	PMA 226	112	133	1.1875	18	AIR 1.0	35	39	1.114285714
19	PMA 170	32	36	1.125	19	AIR 4.0	602	667	1.107973422
20	PMA 281	130	145	1.115384615	20	PEO-W	76	84	1.105263158
21	PMA 299	1343	1494	1.112434847	21	AIR 5.0	492	543	1.103658537
22	PMA 257	296	329	1.111486486	22	PMA 266	123	135	1.097560976
23	AIR 6.0	235	259	1.10212766	23	PMA 290	581	630	1.084337349
24	PMA 231	492	542	1.101626016	24	PMA 261	220	238	1.081818182
25	PEO-JSF	235	258	1.09787234	25	PMA 234	250	269	1.076
26	PMA 234	228	248	1.087719298	26	PMA 268	295	314	1.06440678
27	PMA 261	590	636	1.077966102	27	PMA 264	120	127	1.058333333
28	PMA 242	377	401	1.063660477	28	PMA 259	93	98	1.053763441
29	AIR 4.0	129	137	1.062015504	29	PMA 280	51	53	1.039215686
30	PMA 259	168	177	1.053571429	30	PMA 231	267	277	1.037453184
31	SPARES	406	427	1.051724138	31	PMA 242	175	179	1.022857143
32	PMA 280	275	285	1.036363636	32	PMA 257	109	111	1.018348624
33	PMA 266	175	178	1.017142857	33	PEO-JSF	273	275	1.007326007
34	AIR 10.0	7	7	1	34	PMA 208	175	176	1.005714286
35	AIR 7.0	8	8	1	35	PMA 262	359	360	1.002785515
36	PMA 208	99	99	1	36	AIR 10.0	7	7	1
37	PMA 262	8	8	1	37	PMA 263	96	96	1
38	PMA 263	53	53	1	38	PMA 271	2	2	1

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